

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
EVVA, ITEM 108 ----- 0108-10008-21 (1)	2/2	108FM04 Physical jamming of center/side eye shades(s). Defective material, foreign matter causing obstruction. Loose or misaligned slide track. Impact. Defective lever assembly. Eye shades warped.	END ITEM: Eye shade(s) cannot be moved. GFE INTERFACE: Loss of use of eye shades. MISSION: Terminate EVA due to blocked vision. CREW/VEHICLE: None.	A. Design - Protection against jamming due to contamination or foreign matter is provided by the EVVA shell, tight tolerances, surface finish and lubrication. The eyeshades are completely covered in the "up" position by the EVVA shell. This leaves only the open edge of the visor/eyeshade stack-up exposed to contamination. The tight gap between visors and eyeshades at this edge makes it unlikely that foreign matter could jam in the eyeshades. This same gap protects the eyeshades from being jammed in the "down" position. The contour and surface finish of the eyeshades makes it unlikely that contaminants or foreign matter could stick to them. The center eyeshade moves on two tracks by way of an actuator mechanism at the EVVA pivots. The side shades are activated manually via a tab on the front of each shade. All three shades pivot at the EVVA pivots. Tight tolerances in the actuator mechanism greatly reduces the possibility of contaminants entering the working mechanism to cause a jam. Further protection against jamming of the actuator mechanism is provided by the surface finish of the pivot shaft (100), the use low coefficient of friction teflon washer as spacers, and a dry film lubricant (Dow Corning 321). Lever dimensions were designed to clear the shell through the range of motion used to actuate the center eyeshade; precluding jamming by interference. The lever is retained by a special screw that goes through the pivot shaft, ensuring positive location of the lever. Axial play of the lever on the pivot is eliminated by this screw and, as a result, interference is eliminated. Incidence of jamming as a result of defective or loose lever screws is precluded by adherence to torque requirements for screw installation and the use of self-locking screws. The design of the lever visor drag mechanism uses a vespel friction pad against a stainless steel flange with a 63 finish. Correct tolerancing and use of these materials, which will not gall or bind, makes it unlikely that lever drag mechanism could cause the center eyeshade to jam. The eyeshades are designed to control warping. The center eyeshade shape is retained by the capture mode at the two pivots by the two 7075-T73 aluminum track and polyube coated aluminum 6061-T6 guide mechanisms near the top assembly, by 17-4 pH H1050 stainless steel stiffening spacers at the pivots and by molded in stiffening ridges at the lead and trailing edges. The side eyeshades are each captured at one pivot. They are further stiffened by molded-in finger-shaped 17-4 pH H1050 stainless steel spacers at the pivots and by the actuation tab. In the raised position, the eyeshades are almost completely protected from impact by the EVVA shell and TMG. In the deployed or down position, several features of the eyeshade would help resist impact damage. The eyeshades are a fiberglass epoxy laminated with a smooth white polyurethane coating. Each of the shades could absorb impact force by bending or deforming then returning to their original shape. Greater impact energy could be absorbed by deformation of the adjacent eyeshade or sun visor. The smooth finish and rounded surfaces of the eyeshades would cause some impact force to glance off. The polycarbonate EVVA shell, which is mounted to the helmet using rubber pads, would absorb some
			TIME TO EFFECT /ACTIONS: Seconds.	
			TIME AVAILABLE: N/A	
			TIME REQUIRED: N/A	
			REDUNDANCY SCREENS: A-N/A B-N/A C-N/A	

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
--------------------	------	-----------------------------	----------------	--------------------------

108FM04

impact force in the raised or deployed positions either by deflection of the shell, compression of the pads, or both.

B. Test -
 Acceptance -

The EVVA Assembly is subjected to testing at Airlock per ATP 9833 with ILC source verification. Operational starting force of side eyeshades (1.0 to 2.0 lbs.) and starting torque of center eyeshades (4.5 to 10.0 in-lbs.) are both verified.

PDA -

The following tests are conducted at the EVVA Assembly level in accordance with ILC Document 0111-70028J:
 Verify starting force required to operate side eyeshades.
 Verify starting torque required to operate center eyeshade.

Certification -

The EVVA was successfully tested during SSA certification to duplicate operational life (Ref. ILC Document Memorandum, EM 83-1083 and EM 98-0008). The following usage reflecting requirements of significance to the eyeshades was documented during certification testing:

Requirement	S/AD	Actual
-----	----	-----
Visor actuation	266	778
Integration	4	60

C. Inspection -

Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the material received is as identified in the procurement documents; that no damage has occurred during shipment; and that supplier certifications have been received which provide traceability information.

Source inspection verifies cleanliness and dimensional conformance to operational sheet instructions.

During PDA, per ILC Document 0111-70028J, MIP's are performed to visually verify no damage or wear and cleanliness to VC level.

D. Failure History -

B-EMU-105-A002 (12/26/91) - The right center eyeshade guide came loose due to improper screw locking strip engagement with the nut plate. Only one screw length was allowed for all guide/shim configurations which did not allow for proper screw locking strip engagement with the nut plate in all cases. Added four screw lengths to cover all shim stack-up configurations. In addition, a minimum screw running torque of 0.5 in-lbs for at least two full turns must be met before the final torque of 7-9 in-lbs is applied.

B-EMU-108-A003 (02/25/92) - The EVVA center eyeshade guide broke into two pieces at BAO during torquing of the guide mounting screws. The breakage was attributed to excessive torque above the specification requirement of 7-9 in-lbs. The guide screw retrofit will now be accomplished by Airlock, the

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		108FM04		<p>manufacturing facility to control the screw torquing process.</p> <p>B-EMU-108-A004 (9/3/92) - The vespel left center eyeshade track guide of the EVVA shell was cracked due to extrusion of the vespel material into the larger EVVA shell screw hole when the attachment screw was torqued down. The guide material has been changed from Vespel SP-21 (ultimate strength: 8000 psi) to aluminum T6061 (ultimate strength: 42,000 psi).</p> <p>B-EMU-108-A006 (01/07/94) - The EVVA right vespel guide cracked due to contact with the center eyeshade caused by improper guide installation. When correctly installed, the guide should not contact the track. No corrective action was taken.</p> <p>E. Ground Turnaround - Tested for non-EET processing per FEMU-R-001, Pre-Flight Test Requirements, sun visor and eyeshade torque. None for EET processing. Additionally, every 4 years from date of original EVVA and helmet interface the EVVA is removed from the helmet and completely inspected for structural integrity/material damage.</p> <p>F. Operational Use - Crew Response - Pre/post-EVA : Troubleshoot problem. If vision totally obscured, terminate EVA operations. EVA : If vision not totally obscured, continue EVA operations. If vision totally obscured, terminate EVA.</p> <p>Special Training - No training specifically covers this failure mode.</p> <p>Operational Considerations - EVA checklist procedures verify hardware integrity and systems operational status prior to EVA.</p>

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-108 EXTRAVEHICULAR VISOR ASSEMBLY (EVVA)
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: *J. Plummer* 3/27/02
HS - Project Engineering

Approved by: *[Signature]* 3/27/02
NASA - SSA/SSM

M. Snyder
HS - Reliability

[Signature] 5/14/02
NASA - EMU/SSM

[Signature]
HS - Engineering Manager

[Signature] 5/17/02
NASA - S & MA

[Signature] 5/23/02
NASA - MOB

[Signature] 6/04/02
NASA - Crew

[Signature] 6/14/02
NASA - Program Manager